

SOUTHERLY ALLOY

Incoloy 800 / 800H / 800HT | UNS N08800 / N08810 / N08811 | Werkstoff Nr. 1.4876 / 1.4958 / 1.4959

ASTM B408 / B409 / B407 / B163 — Nickel-Iron-Chromium Alloy, All Product Forms

Product Description

Incoloy 800, 800H, and 800HT share one iron-nickel-chromium base and differ in the carbon window, the Al+Ti total, and the annealed grain size. UNS N08800 serves general high-temperature duty to about 593 °C and carries the highest room-temperature strength of the three. The controlled-carbon UNS N08810 and UNS N08811 grades anneal to ASTM No. 5 or coarser grain, which is what gives them their creep-rupture life above 593 °C. Oxidation and carburization resistance hold up across the series, so reformers, cracking furnaces, heat-treatment equipment, and boiler plant are the usual destinations.

Chemical Composition

Element	Alloy 800 (UNS N08800)	Alloy 800H (UNS N08810)	Alloy 800HT (UNS N08811)
Nickel (Ni)	30.0–35.0%	30.0–35.0%	30.0–35.0%
Chromium (Cr)	19.0–23.0%	19.0–23.0%	19.0–23.0%
Iron (Fe)	39.5% min.	39.5% min.	39.5% min.
Carbon (C)	0.10% max.	0.05–0.10%	0.06–0.10%
Aluminium (Al)	0.15–0.60%	0.15–0.60%	0.25–0.60%
Titanium (Ti)	0.15–0.60%	0.15–0.60%	0.25–0.60%
Aluminium + Titanium	0.30–1.20%	0.30–1.20%	0.85–1.20%
Copper (Cu), max.	0.75%	0.75%	0.75%
Manganese (Mn), max.	1.50%	1.50%	1.50%
Silicon (Si), max.	1.00%	1.00%	1.00%
Sulfur (S), max.	0.015%	0.015%	0.015%
Annealed grain size	Not specified	ASTM 5 or coarser	ASTM 5 or coarser

One composition table serves ASTM B407, B408, B409, and B163. Iron is determined arithmetically by difference, and the Al+Ti total applies to alloy UNS N08811 alone.

Minimum Room-Temperature Mechanical Properties by Product Form

Standard / Form / Grade and Condition	Tensile Strength, min.	Yield Strength (0.2%), min.	Elongation, min.
B408 rod and bar – N08800 hot-worked, as-hot-worked	≥ 80 ksi (550 MPa)	≥ 35 ksi (240 MPa)	25%
B408 rod and bar – N08800 cold- and hot-worked, annealed	≥ 75 ksi (515 MPa)	≥ 30 ksi (205 MPa)	30%
B408 rod and bar – N08810 / N08811, annealed	≥ 65 ksi (450 MPa)	≥ 25 ksi (170 MPa)	30%
B409 plate – N08800 hot-rolled, annealed	≥ 75 ksi (520 MPa)	≥ 30 ksi (205 MPa)	30%
B409 plate – N08800 as-rolled	≥ 80 ksi (550 MPa)	≥ 35 ksi (240 MPa)	25%
B409 sheet and strip – N08800, annealed	≥ 75 ksi (520 MPa)	≥ 30 ksi (205 MPa)	30%
B409 sheet and strip – N08810 / N08811, annealed	≥ 65 ksi (450 MPa)	≥ 25 ksi (170 MPa)	30%
B407 seamless pipe and tube – N08800 cold-drawn, annealed	≥ 75 ksi (520 MPa)	≥ 30 ksi (205 MPa)	30%
B407 seamless pipe and tube – N08800 hot-finished	≥ 65 ksi (450 MPa)	≥ 25 ksi (170 MPa)	30%
B407 seamless pipe and tube – N08810 / N08811, annealed	≥ 65 ksi (450 MPa)	≥ 25 ksi (170 MPa)	30%
B163 heat-exchanger tube – N08800, annealed	≥ 75 ksi (517 MPa)	≥ 30 ksi (207 MPa)	30%
B163 heat-exchanger tube – N08800, cold-worked	≥ 83 ksi (572 MPa)	≥ 47 ksi (324 MPa)	30%
B163 heat-exchanger tube – N08810 / N08811, annealed	≥ 65 ksi (448 MPa)	≥ 25 ksi (172 MPa)	30%

Each standard writes its own MPa conversion, so the same UNS number can show two different figures for one ksi value. B409 waives the yield requirement under 0.51 mm (0.020 in.)

thickness, and B408 furnishes forging quality to chemical and surface requirements alone. The laboratory rates every controlled-carbon heat to ASTM E112.

Physical Properties (typical values)

Property	Value
Density	Approx. 7.94 g/cm ³
Melting range	Approx. 1357–1385 °C
Specific heat, 0–100 °C	Approx. 460 J/kg·°C
Modulus of elasticity at 20 °C	Approx. 196.5 GPa
Thermal conductivity at 20 °C	Approx. 11.5 W/m·K
Thermal expansion, 20–100 °C	Approx. 14.4 µm/m·°C
Electrical resistivity at 20 °C	Approx. 0.989 µΩ·m
Curie temperature	Approx. –115 °C
Magnetic behaviour	Non-magnetic at ambient temperature
Hardness, annealed	Approx. 138 HB

Typical values hold for all three designations, because the carbon window does not change the physical base. They support design work rather than acceptance testing.

Applicable Standards

Standard / Designation	Scope
ASTM B408 / ASME SB408	Nickel-iron-chromium alloy rod and bar – UNS N08800, N08810, N08811
ASTM B409 / ASME SB409 (with B906)	Rolled plate, sheet, and strip – UNS N08800, N08810, N08811
ASTM B407 / ASME SB407 (with B829)	Seamless pipe and tube – UNS N08800, N08810, N08811
ASTM B163 / ASME SB163	Seamless condenser and heat-exchanger tube
ASTM B514 / B515 (with B775 / B751)	Welded pipe, and welded tube
ASTM B564 / B366	Forgings, and wrought pipe fittings
SAE AMS 5766	Alloy 800 bars, forgings, and forging stock, solution heat treated – UNS N08800, 4.0 in. (102 mm) and under
SAE AMS 5871	Alloy 800 sheet, strip, and plate, solution heat treated – UNS N08800 in 0.25–50.8 mm
ASME Code Cases 1325 / 1983 / 1987	Elevated-temperature design allowables for 800H and 800HT
W.Nr. 1.4876 / 1.4958 / 1.4959	EN X10NiCrAlTi32-20 / X5NiCrAlTi31-20 / X8NiCrAlTi32-21
EN 10095 · DIN 17459 / 17460	European heat-resisting materials standards, by product form
BS 3072 / 3073 / 3074 / 3076 (NA 15 series)	British flat, tubular, and bar product standards for the NA 15 series
JIS NCF 800 / 800H / 800HT · G 4902	Japanese designations and flat-product standard
ISO FeNi32Cr21AlTi (NW8800 / NW8810 / NW8811)	ISO designations, the HC and HT suffixes marking the controlled-carbon grades
ISO 9723 / 9725 · ISO 6207 / 6208	Bar and forging stock; seamless tube; plate, sheet, and strip

Typical Supply Dimensions

Product Form	Typical Supply Range	Length
Round bar	6–500 mm dia.	Cut to length or random
Seamless pipe	6–219 mm outside dia.	Random or fixed
Heat-exchanger tube	6–76 mm outside dia.	Fixed
Welded pipe and tube	12–2032 mm outside dia.	Random or fixed
Hot-rolled plate	3–100 mm thick	Up to 6000 mm
Cold-rolled sheet and strip	0.25–3.5 mm thick	Coil or cut length

Service ceiling: ASTM B407, B408, and B409 all name 1100 °F (593 °C) as the normal limit for UNS N08800, and the controlled-carbon grades take over above that line where resistance to creep and rupture governs. ASME Code Case 1325 carries the 800H Section I allowables, Code Case 1983 extends the Section VIII Division 1 allowables to 1800 °F (982 °C), and Code Case 1987 covers 800HT. Both controlled-carbon grades anneal to ASTM No. 5 or coarser grain, which is what the creep duty rests on.

Southerly Alloy — nickel alloy bar, rod, pipe, tube, plate and fittings · www.southerly-alloy.com · Values are for reference; the mill test certificate prevails for final acceptance.